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Parallaxes of 516 Stars, from Photographs taken with the 24-inch Refractor of the Radcliffe Observatory, Oxford. By Dr. Arthur A. Rambaut, M.A., F.R.S.

It is intended to publish shortly a volume giving observations, reductions, and discussions relating to the recent Radcliffe determinations of stellar parallaxes of 2408 stars, which will contain the separate results obtained for each star.

In the present paper are given the mean results for all those stars which have been satisfactorily measured on at least four plates, together with those for a few stars (26) observed on a smaller number of plates, which have been included for reasons stated in the notes.

As full details will be published in the intended Radcliffe volume, it may be sufficient briefly to confine ourselves here to a few particulars.

In the exposure of the plates and the methods of measurement and reduction Kapteyn's well-known scheme has been generally followed. The plates were taken on dates between 1904 October and 1908 March, and all images—twelve for each star—were measured in two positions differing by 180°.

In the table of parallaxes given below the B.D. number (column 2) is printed in italics when, owing to precession, the degree differs from that in column 5.

The photographic magnitudes (column 3) have been specially derived from the Radcliffe plates themselves.

The values of π_c (column 8) have been obtained from those of π by applying to them corrections to eliminate magnitude-error. In the determination of this error the values of π were first arranged in order of star-magnitude, and smoothed means as

deduced from separate plates were taken for each magnitude; from these were deducted the corresponding means from the whole series of plates (45 in all) for each magnitude, and the differences with signs changed were adopted as the corrections for magnitude-error applicable to the particular plate. By this method that part of the error depending on magnitude which is peculiar to each plate is removed, whilst that part of it which may be assumed to be real remains in the values so corrected, which are given under the heading π_c. It will be observed, too, that in the great majority of cases π_c differs but little from π, the brighter stars being affected most.

The parallaxes are relative, the mean magnitude of the comparison stars being about 11.

A few remarks made by the measurer are appended under the heading "Notes." The notes also include spectral types, taken from the Draper Catalogue; proper motions, from Porter's Catalogue (*Publ. Cinc. Obs.*, No. 18), *Groningen Publications* (No. 14), and other stated sources; and parallaxes, trigonometric and spectroscopic, from various authorities, chiefly from *Ap. J.*, 53, 1, and *Groningen Publications* (No. 23). All stars to which notes refer are marked by an asterisk in the first column of the table.

The positions of the "Central Stars" of each Group for the epoch 1900·0 are as follows:—

Group.	Name of Star.	Photo. Magnitude.	R.A. 1900·0.	Decl. 1900·0.
			h m s	° ′
1	B.D. +25° 495	7·7	3 2 32	+25 58·2
2	Nova Persei	Var.	3 24 24	+43 33·7
3	B.D. +41° 750	{8·7 / 9·3}	3 40 12	+41 9·0
4	B.D. +15° 631 (Hyades)	8·3	4 28 53	+15 17·8
5	B.D. +51° 1094	8·2	5 30 24	+51 22·8
6	B.D. +44° 1408	8·9	6 9 33	+44 44·8
7	B.D. +40° 1758	9·5	6 49 30	+40 12·8
8	B.D. +48° 1469	8·4	6 54 0	+48 31·8
9	B.D. +31° 1684	8·3	7 47 10	+30 54·8

These Groups were selected for observation by the advice and at the suggestion of Professor Kapteyn, to whom I am indebted for much valuable counsel and assistance in the earlier stages of the work. The arrangement of the programme of operations was made with his collaboration, and some of the earlier plates were sent at his request to Groningen and measured on his machine. The results of these measures will be included in the projected Radcliffe volume referred to above.

GROUP I.

No. in Radcliffe Catalogue of Paral-laxes.	No. in B.D.	Photo. Magni-tude.	R.A. 1900·0. h m s	Decl. N. 1900·0. ° ′	Number of Plates.	π	π_c	P.E.
12	...	10·4	2 59 46	25 45·2	4	+″·029	+″·022	±″·013
17	...	10·8	2 59 51	26 19·6	4	+·007	−·001	±·017
18	...	11·7	2 59 56	26 7·9	4	+·033	+·035	±·015
19	...	11·6	2 59 57	26 15·9	4	+·033	+·033	±·022
20	...	12·1	3 0 0	25 55·0	4	+·006	+·010	±·017
24	...	11·5	3 0 14	26 4·5	4	−·007	−·007	±·015
27	487	9·5	3 0 20	25 39·1	4	+·051	+·025	±·014
29	...	11·4	3 0 24	25 50·3	4	+·005	+·005	±·016
30	...	12·3	3 0 25	25 59·0	4	−·016	−·013	±·018
33	...	12·0	3 0 31	25 37·1	4	−·032	−·030	±·013
34	...	11·6	3 0 31	26 3·1	4	+·009	+·010	±·020
35	*488*	11·5	3 0 31	26 10·2	4	+·024	+·025	±·015
43	...	12·4	3 0 50	25 51·5	4	−·058	−·055	±·017
44	...	12·1	3 0 50	25 52·9	4	−·041	−·037	±·019
49	...	11·5	3 1 7	25 48·3	5	·000	+·003	±·013
50	509	10·0	3 1 9	26 34·5	4	−·013	−·015	±·014
52	*490*	9·8	3 1 17	26 7·3	5	+·031	+·020	±·013
53	510	10·6	3 1 17	26 14·7	5	+·024	+·017	±·013
55	...	10·6	3 1 19	25 21·9	4	+·032	+·030	±·018
56	492	9·8	3 1 20	25 28·7	4	+·024	+·011	±·016
57	...	11·4	3 1 20	26 6·4	5	−·037	−·036	±·015
60	...	11·2	3 1 23	25 25·9	4	−·014	−·012	±·017
61	...	11·5	3 1 23	25 38·5	5	+·001	+·003	±·013
64	...	11·5	3 1 27	25 36·3	5	−·023	−·022	±·012
66	...	11·8	3 1 33	25 51·8	5	−·004	−·002	±·016
69	...	12·2	3 1 39	26 17·1	4	−·054	−·051	±·017
70	493	10·4	3 1 40	25 32·8	4	−·010	−·016	±·018
71	...	12·0	3 1 49	26 9·6	4	−·024	−·020	±·015
73	...	11·8	3 1 53	25 57·3	5	+·011	+·014	±·022
75	...	11·1	3 1 56	25 23·4	4	−·019	−·016	±·016
76	...	11·8	3 1 56	25 57·0	5	−·028	−·025	±·014
79	494	10·7	3 2 1	25 40·5	5	+·026	+·023	±·012
80	...	10·7	3 2 4	25 32·5	4	+·005	+·004	±·014
81	...	11·2	3 2 7	25 54·3	5	−·018	−·016	±·015
83	...	10·5	3 2 17	25 54·7	5	−·017	−·023	±·017

GROUP 1—*continued.*

No. in Radcliffe Catalogue of Parallaxes.	No. in B.D.	Photo. Magnitude.	R.A. 1900·0. h m s	Decl. N. 1900·0. ° ′	Number of Plates.	π	π_c	P.E.
						″	″	″
89*	495	7·7	3 2 32	25 58·2	5	+ ·102	+ ·038	± ·018
90*	496	8·4	3 2 33	25 35·2	4	+ ·093	+ ·040	± ·018
94	...	11·4	3 2 44	26 17·6	5	− ·001	·000	± ·015
99	...	11·8	3 2 48	26 0·1	5	+ ·022	+ ·025	± ·013
100	...	11·7	3 2 59	26 12·0	5	− ·029	− ·027	± ·015
101	498	10·6	3 3 2	25 53·6	5	+ ·037	+ ·033	± ·018
103	...	11·3	3 3 4	25 30·4	4	− ·026	− ·023	± ·013
104*	499	9·7	3 3 4	25 58·7	5	+ ·007	− ·007	± ·016
108	...	11·2	3 3 13	25 22·1	4	+ ·007	+ ·010	± ·015
109	...	11·5	3 3 16	25 28 3	4	− ·045	− ·043	± ·023
110	...	11·7	3 3 16	26 10·1	5	− ·001	+ ·001	± ·016
111	...	10·6	3 3 20	26 7·0	5	− ·001	− ·005	± ·013
113	...	11·0	3 3 28	25 39·6	5	+ ·004	+ ·005	± ·013
116	513	9·4	3 3 32	26 18·7	5	+ ·032	+ ·008	± ·015
117	...	11·9	3 3 32	25 55·1	4	− ·006	− ·002	± ·016
119	...	10·9	3 3 37	26 2·7	5	+ ·022	+ ·023	± ·012
121	500	9·9	3 3 50	25 54·8	5	+ ·032	+ ·020	± ·015
127	501	10·2	3 3 59	25 34·3	4	+ ·002	− ·003	± ·017
128	...	11·1	3 4 1	25 42·9	5	− ·019	− ·019	± ·013
138	502	9·7	3 4 24	25 42·9	4	+ ·056	+ ·041	± ·014
139	503	10·1	3 4 24	25 58·2	4	− ·005	− ·017	± ·014
144	515	10·3	3 4 32	26 15·6	4	+ ·031	+ ·019	± ·018
151	...	11·1	3 4 51	26 4·0	4	− ·012	− ·011	± ·013
152	...	11·8	3 4 57	26 15·6	4	− ·038	− ·035	± ·016
			GROUP 2 (*Nova Persei* region).					
228	...	11·5	3 21 0	43 44·9	4	+ ·009	+ ·007	± ·019
237	...	11·5	3 21 11	43 45·2	4	+ ·010	+ ·009	± ·017
262	...	11·0	3 21 37	43 19·9	4	+ ·018	+ ·018	± ·011
275	...	11·7	3 21 50	43 53·2	4	+ ·016	+ ·012	± ·011
279	...	11·7	3 21 55	43 51·6	4	+ ·002	− ·002	± ·016
282	...	11·1	3 22 1	43 11·2	4	− ·040	− ·042	± ·013
290	734	10·8	3 22 14	43 50·9	5	+ ·026	+ ·024	± ·008
295	...	11·7	3 22 20	43 17·1	5	+ ·006	+ ·003	± ·010
298	...	10·9	3 22 23	43 8·0	4	+ ·028	+ ·029	± ·016
300	...	11·0	3 22 26	43 18·4	5	+ ·008	+ ·008	± ·009

GROUP 2—*continued*

No. in Radcliffe Catalogue of Parallaxes.	No. in B.D.	Photo. Magnitude.	R.A. 1900·0. h m s	Decl. N. 1900·0. ° ′	Number of Plates.	π	π_c	P.E.
						″	″	″
304	...	11·7	3 22 35	43 1·1	4	− ·004	− ·005	± ·016
306	...	11·9	3 22 36	43 15·4	4	+ ·007	+ ·007	± ·014
310	...	11·8	3 22 40	43 45·8	4	− ·011	− ·012	± ·011
311	...	11·9	3 22 43	43 9·4	4	− ·009	− ·010	± ·013
318	...	11·1	3 22 49	43 23·9	5	− ·004	− ·004	± ·009
321	...	11·0	3 22 52	43 36·8	5	+ ·018	+ ·018	± ·013
325	...	10·9	3 23 0	43 43·0	5	+ ·002	+ ·002	± ·009
327	...	11·6	3 23 1	43 52·3	5	− ·012	− ·015	± ·011
329	...	11·4	3 23 2	43 40·0	5	− ·011	− ·013	± ·015
330	...	10·8	3 23 3	43 50·2	5	− ·010	− ·011	± ·011
331	...	11·6	3 23 5	43 1·7	4	− ·021	− ·020	± ·011
333	...	11·2	3 23 7	43 50·5	5	− ·003	− ·006	± ·011
335	...	11·5	3 23 16	43 53·2	5	+ ·063	+ ·062	± ·011
336	735	10·9	3 23 19	43 37·1	5	+ ·015	+ ·016	± ·011
337	...	10·9	3 23 21	44 2·7	4	+ ·015	+ ·015	± ·010
344	...	11·9	3 23 30	43 2·1	4	+ ·009	+ ·008	± ·016
345	...	11·9	3 23 32	43 0·9	4	− ·049	− ·049	± ·013
346	...	11·5	3 23 32	43 8·4	4	+ ·012	+ ·010	± ·011
349	736	10·6	3 23 35	43 17 1	5	+ ·001	+ ·002	± ·011
351	737	11·2	3 23 38	43 23·9	5	+ ·004	+ ·002	± ·011
354	...	11·6	3 23 47	43 12·2	4	+ ·001	− ·001	± ·011
356	...	11·3	3 23 50	44 3·8	4	+ ·011	+ ·012	± ·010
359	...	10·6	3 23 55	42 59·7	4	+ ·024	+ ·025	± ·010
360	738	11·0	3 23 56	43 21·1	5	+ ·037	+ ·037	± ·009
361	...	11·9	3 23 59	43 32·1	4	− ·034	− ·037	± ·011
363	...	11·2	3 24 2	44 4·8	4	+ ·047	+ ·047	+ ·010
364	...	11·7	3 24 3	43 4·7	4	− ·026	− ·027	± ·010
365	...	11·9	3 24 3	43 29·7	4	− ·022	− ·027	± ·013
367	...	10·9	3 24 4	43 12·0	5	− ·002	− ·002	± ·008
380*	...	Var.	3 24 24	43 33·7	5	+ ·027	+ ·027	± ·009
381	...	10·9	3 24 24	43 23·0	5	− ·008	− ·008	± ·008
382	...	11·4	3 24 25	43 1·0	4	+ ·003	+ ·004	± ·011
386	...	10·7	3 24 28	44 1·2	4	− ·012	− ·012	± ·009
389	...	11·7	3 24 32	43 53·3	5	− ·008	− ·010	± ·009
391	...	11·4	3 24 33	43 56·8	4	− ·011	− ·011	± ·011

GROUP 2—*continued.*

No. in Radcliffe Catalogue of Parallaxes.	No. in B.D.	Photo. Magnitude.	R.A. 1900·0.	Decl. N. 1900·0.	Number of Plates.	π	π_c	P.E.
			h m s	° ′		″	″	″
401*	741	10·4	3 24 54	43 53·4	4	+·041	+·043	±·011
402	...	11·8	3 24 55	43 13·6	4	−·015	−·015	±·014
405	...	10·5	3 24 59	43 33·8	4	+·030	+·031	±·013
409	743	10·0	3 25 7	43 42·2	4	+·044	+·043	±·016
412	...	10·3	3 25 10	43 17·4	4	+·003	+·006	±·011
418	...	11·7	3 25 17	43 45·3	4	·000	−·004	±·013
424	...	11·6	3 25 27	43 59·9	4	−·020	−·021	±·011
427	...	10·8	3 25 39	43 5·7	4	+·002	+·003	±·016
434	...	10·9	3 25 48	43 5·4	4	·000	−·001	±·009
435	747	10·4	3 25 49	43 12·9	5	+·013	+·014	±·009
436	...	11·7	3 25 49	43 15·5	5	+·003	·000	±·012
438	...	11·0	3 25 53	43 49·1	5	+·008	+·005	±·010
439	777	11·1	3 25 54	43 7·9	4	−·001	−·002	±·011
441	...	11·5	3 25 55	44 2·5	4	−·019	−·019	±·012
442	...	11·3	3 25 57	43 16·6	5	−·002	−·004	±·010
443	...	11·2	3 25 58	43 0·8	4	+·015	+·014	±·015
445	...	11·0	3 25 58	43 35·9	5	+·004	+·003	±·010
448	...	11·9	3 25 59	44 4·7	4	−·053	−·053	±·012
450	...	10·5	3 26 2	43 2·3	4	−·010	−·012	±·010
452*	749	10·3	3 26 5	43 25·3	4	+·032	+·035	±·017
453	...	11·7	3 26 8	43 30·9	5	·000	−·002	±·011
454	...	11·5	3 26 9	44 5·6	4	−·002	−·004	±·011
456	750	10·3	3 26 10	43 23·2	4	+·016	+·019	±·015
464	...	11·7	3 26 17	43 19·3	4	−·025	−·029	±·010
465	...	10·7	3 26 17	43 46·8	4	−·009	−·011	±·012
466	...	11·5	3 26 17	43 59·0	4	−·028	−·028	±·014
468	...	10·8	3 26 20	44 5·3	4	−·003	−·005	±·014
478	...	11·6	3 26 33	43 43·0	4	+·008	+·004	±·013
479	...	11·0	3 26 34	43 19·5	4	·000	+·001	±·013
483	...	11·2	3 26 46	43 19·1	4	−·038	−·039	±·013
489	754	10·3	3 26 56	43 13·7	4	−·017	−·013	±·010
499	...	11·7	3 27 10	43 33·3	4	−·007	−·010	±·010
500	...	11·7	3 27 11	43 38·5	4	+·010	+·007	±·011
503	...	11·5	3 27 13	43 22·8	4	−·022	−·024	±·016
513	...	10·9	3 27 28	43 43·5	4	−·019	−·018	±·012

GROUP 3.

No. in Radcliffe Catalogue of Parallaxes.	No. in B.D.	Photo. Magnitude.	R.A. 1900·0. h m s	Decl. N. 1900·0. ° ′	Number of Plates.	π	π_c	P.E.
658*	750	8·7	3 40 12	41 9·0	1	+″·149	+″·078	±″·030
659*	750	9·3	3 40 12	41 9·0	1	+·068	+·020	±·030

GROUP 4 (*Hyades* region).

757*	647	8·9	4 27 17	15 36·4	4	−·010	+·014	±·011
760*	717	10·4	4 27 39	14 58·9	4	+·042	+·040	±·011
763*	648	8·6	4 27 44	15 44·9	4	−·041	−·007	±·014
768*	649	8·3	4 27 56	15 45·0	4	−·037	+·004	±·020
771*	721	8·7	4 28 17	14 57·2	4	−·021	+·011	±·011
774*	...	10·4	4 28 47	14 56·5	4	−·001	−·002	±·010
777*	651	8·3	4 28 53	15 17·8	4	−·049	−·009	±·011

GROUP 5.

874	...	10·6	5 26 45	51 23·1	4	+·005	+·005	±·008
876	...	10·9	5 26 51	51 16·4	4	−·003	−·003	±·008
877	...	11·2	5 26 51	51 41·1	4	−·002	−·002	±·011
878	1088	9·8	5 26 54	51 31·5	4	+·032	+·036	±·008
881	1089	9·7	5 26 57	51 13·2	4	+·019	+·027	±·008
884	...	11·3	5 27 1	51 14·4	4	−·004	−·004	±·010
894	...	11·6	5 27 27	51 39·9	4	−·007	−·007	±·009
910	...	11·5	5 28 5	51 10·1	4	+·016	+·018	±·008
912	...	10·3	5 28 12	51 54·8	5	−·002	·000	±·008
921	...	11·5	5 28 24	51 0·4	4	−·005	−·002	±·012
922	...	10·2	5 28 26	51 9·6	6	+·008	+·011	±·008
924	...	10·4	5 28 31	50 53·5	5	−·006	−·005	±·009
925	...	11·5	5 28 31	51 25·5	4	+·010	+·011	±·011
926	...	11·2	5 28 34	51 15·8	6	+·004	+·005	±·008
931	...	11·2	5 28 39	51 40·4	5	−·002	−·001	±·009
938	1197	9·6	5 28 51	50 55·3	5	+·004	+·008	±·010
940	...	10·8	5 28 55	50 59·4	5	−·019	−·017	±·008
942	...	11·0	5 28 58	51 2·3	5	+·003	+·004	±·008
948	...	11·3	5 29 7	51 15·2	6	·000	·000	±·008
949	...	11·5	5 29 13	50 48·9	4	−·004	−·001	±·012

GROUP 5—*continued.*

No. in Radcliffe Catalogue of Parallaxes.	No. in B.D.	Photo. Magnitude.	R.A. 1900·0.	Decl. N. 1900·0.	Number of Plates.	π	π_c	P.E.
			h m s	° ′		″	″	″
950	...	11·5	5 29 13	51 24·7	5	+ ·002	+ ·003	± ·013
951	...	11·1	5 29 14	50 55·2	5	− ·012	− ·011	± ·008
952	...	11·1	5 29 15	51 56·7	4	+ ·011	+ ·014	± ·008
958	1090	9·3	5 29 21	51 51·6	5	+ ·009	+ ·013	± ·009
963	...	11·5	5 29 28	50 48·0	4	− ·032	− ·029	± ·011
964	...	10·7	5 29 28	51 0·1	5	− ·014	− ·010	± ·008
965	1091	10·3	5 29 31	51 14·8	6	+ ·006	+ ·009	± ·010
967*	1092	9·2	5 29 37	51 19·8	6	+ ·029	+ ·044	± ·012
973	...	11·0	5 29 45	51 51·5	5	+ ·017	+ ·019	± ·011
983	1201	9·3	5 30 3	50 50·4	5	+ ·028	+ ·034	± ·012
986	1093	9·7	5 30 7	51 17·6	6	+ ·004	+ ·012	± ·010
987	...	11·1	5 30 8	50 46·6	5	+ ·002	+ ·003	± ·008
988	...	11·3	5 30 10	51 21·7	6	+ ·009	+ ·009	± ·008
994*	1094	8·2	5 30 24	51 22·8	6	+ ·064	+ ·084	± ·015
995	1202	9·7	5 30 25	50 50·1	5	+ ·007	+ ·014	± ·008
997	...	11·4	5 30 26	51 43·1	4	− ·008	− ·004	± ·011
1001	...	11·3	5 30 30	51 16·5	6	− ·011	− ·010	± ·008
1002	1095	10·5	5 30 30	51 29·5	6	·000	+ ·001	± ·007
1003*	*1204*	8·6	5 30 31	51 1·7	6	− ·030	− ·008	± ·013
1005	...	10·5	5 30 31	51 50·2	5	− ·001	− ·001	± ·010
1008	...	11·0	5 30 40	50 58·7	5	·000	+ ·002	± ·008
1010	...	11·5	5 30 41	51 21·6	6	− ·015	− ·014	± ·009
1011	1205	9·2	5 30 42	50 55·5	5	·000	+ ·004	± ·011
1012	1207	11·0	5 30 43	50 50·6	5	− ·005	− ·004	± ·009
1013	*1206*	9·2	5 30 43	51 0·1	5	+ ·011	+ ·017	± ·012
1015	...	11·4	5 30 46	51 5·3	6	·000	·000	± ·008
1017	...	11·4	5 30 49	51 3·7	6	+ ·003	+ ·003	± ·008
1021	...	11·2	5 30 51	51 38·5	6	+ ·003	+ ·003	± ·007
1023	...	11·6	5 30 54	51 26·5	6	− ·027	− ·027	± ·006
1026	...	11·1	5 30 56	51 56·3	5	− ·017	− ·015	± ·011
1031	...	10·3	5 31 6	51 55·3	5	+ ·013	+ ·015	± ·009
1033	...	11·5	5 31 7	51 6·6	4	+ ·003	+ ·003	± ·009
1040	...	10·4	5 31 15	51 2·9	6	+ ·009	+ ·011	± ·007
1046*	.	10·9	5 31 22	51 19·3	6	·000	+ ·002	± ·008
1048	...	11·0	5 31 28	51 16·0	4	+ ·013	+ ·014	± ·008

GROUP 5—*continued.*

No. in Radcliffe Catalogue of Parallaxes.	No. in B.D.	Photo. Magnitude.	R.A. 1900·0. h m s	Decl. N. 1900·0. ° ′	Number of Plates.	π	π_c	P.E.
1053*	1096	7·9	5 31 38	51 16·6	6	−″·021	+″·023	±″·018
1054	...	11·3	5 31 41	50 57·7	5	− ·015	− ·014	± ·012
1057	...	10·5	5 31 46	51 10·7	6	− ·001	·000	± ·008
1060	...	10·8	5 31 48	50 54·3	5	− ·006	− ·006	± ·010
1062	1097	9·2	5 31 49	51 8·7	6	+ ·004	+ ·010	± ·010
1063	...	11·5	5 31 50	51 51·6	4	− ·042	− ·039	± ·011
1067	...	11·5	5 31 58	51 12·7	4	− ·006	− ·002	± ·009
1069	1098	10·8	5 32 0	51 41·7	6	+ ·020	+ ·020	± ·007
1070	1098	10·2	5 32 1	51 41·8	6	+ ·001	+ ·003	± ·008
1072	...	11·0	5 32 3	51 45·5	5	+ ·008	+ ·009	± ·008
1077	1211	9·6	5 32 15	50 47·1	5	− ·003	+ ·001	± ·009
1078	1099	10·0	5 32 17	51 50·6	5	+ ·010	+ ·007	± ·009
1082	...	10·5	5 32 22	51 6·0	6	+ ·001	+ ·004	± ·007
1083	...	11·3	5 32 22	51 15·4	6	+ ·003	+ ·003	± ·008
1095	...	10·9	5 32 56	51 40·8	5	+ ·004	+ ·005	± ·008
1102	...	11·5	5 33 10	51 3·0	5	+ ·031	+ ·029	± ·016
1103	...	10·5	5 33 12	51 44·7	4	+ ·004	+ ·005	± ·012
1109	...	11·5	5 33 17	51 7·8	4	+ ·009	+ ·007	± ·009
1114	1100	10·4	5 33 26	51 11·0	5	+ ·006	+ ·012	± ·009
1118	...	11·2	5 33 37	51 33·6	5	− ·023	− ·023	± ·011
1119	1101	10·1	5 33 43	51 36·6	5	+ ·012	+ ·016	± ·010
1120	...	10·3	5 33 49	51 45·4	4	+ ·012	+ ·014	± ·010
1121	...	11·1	5 33 52	50 51·8	4	− ·014	− ·014	± ·015
1122	...	10·4	5 33 56	50 57·9	4	− ·017	− ·015	± ·008
1123	1102	9·5	5 33 58	51 10·2	5	+ ·011	+ ·022	± ·011
1124	...	10·6	5 34 0	51 5·6	5	− ·020	− ·016	± ·009

GROUP 6.

1179*	1395	9·4	6 6 0	44 55·7	4	+ ·007	+ ·004	± ·013
1180	1264	9·0	6 6 2	45 4·5	4	+ ·026	+ ·022	± ·011
1200*	1396	8·1	6 6 30	44 46·6	5	+ ·065	+ ·047	± ·010
1203	1397	9·2	6 6 34	44 36·3	5	− ·007	− ·008	± ·007
1216	1398	10·1	6 7 3	44 10·3	4	·000	+ ·004	± ·007

GROUP 6—*continued.*

No. in Radcliffe Catalogue of Paral-laxes.	No. in B.D.	Photo. Magni-tude.	R.A. 1900·0. h m s	Decl. N. 1900·0. ° ′	Number of Plates.	π	π_c	P.E.
1226	1265	9·2	6 7 14	45 2·9	5	+″·007	+″·004	±″·008
1229	...	10·8	6 7 19	44 40·8	4	−·007	−·002	±·008
1232*	1399	7·2	6 7 21	44 36·7	5	+·045	+·011	±·013
1238	1400	9·9	6 7 35	44 8·9	5	−·005	−·001	±·008
1239	1401	10·1	6 7 38	44 11·1	6	+·002	+·007	±·008
1240	1266	10·6	6 7 39	45 7·5	6	+·008	+·014	±·008
1243	1268	9·8	6 7 40	45 3·4	7	−·001	+·004	±·007
1246	...	10·5	6 7 43	45 5·8	7	+·001	+·007	±·008
1248	...	10·3	6 7 46	44 18·4	6	+·001	+·005	±·008
1250	1402	10·2	6 7 50	44 11·3	6	−·011	−·005	±·006
1251	1402	10·5	6 7 50	44 11·5	6	+·013	+·018	±·007
1254	...	10·7	6 7 53	44 9·1	4	+·011	+·017	±·008
1260	1269	9·6	6 8 0	45 9·9	6	−·014	−·009	±·008
1262	...	10·7	6 8 2	44 59·6	7	−·011	−·008	±·007
1270	...	10·9	6 8 12	44 21·8	5	−·026	−·021	±·007
1271	...	10·9	6 8 14	45 16·8	5	−·008	−·003	±·009
1274	1403	9·9	6 8 17	44 18·0	6	+·006	+·012	±·006
1275	1271	9·4	6 8 19	45 9·6	6	+·009	+·018	±·008
1278	...	10·8	6 8 21	45 7·8	6	+·004	+·009	±·007
1284	...	10·9	6 8 25	44 31·3	5	−·029	−·025	±·008
1285	1404	9·6	6 8 26	44 42·2	7	+·006	+·012	±·006
1291	...	10·4	6 8 34	44 12·1	5	−·006	−·001	±·007
1296	..	10·7	6 8 39	45 15·8	5	−·016	−·009	±·006
1298	1405	10·0	6 8 42	44 7·6	4	−·016	−·014	±·009
1301	...	11·0	6 8 46	44 57·8	4	−·015	−·012	±·011
1302	...	11·2	6 8 47	44 20·0	4	−·008	−·005	±·007
1303	...	11·0	6 8 47	44 44·2	6	+·008	+·013	±·010
1309	...	11·2	6 8 54	44 20·6	4	−·020	−·017	±·011
1310	...	10·7	6 8 54	44 54·3	7	−·027	−·022	±·007
1311	1274	9·4	6 8 54	45 4·9	7	−·021	−·019	±·009
1313	...	10·9	6 8 56	44 43·5	7	+·016	+·020	±·008
1317	1275	9·7	6 8 58	45 13·6	6	·000	+·007	±·008
1319	...	10·4	6 9 3	44 14·0	6	+·001	+·006	±·006
1320	1406	10·2	6 9 6	44 39·7	7	·000	+·006	±·006
1324	1407	10·3	6 9 14	44 33·5	7	−·009	−·003	±·007

GROUP 6—*continued.*

No. in Radcliffe Catalogue of Parallaxes.	No. in B.D.	Photo. Magnitude.	R.A. 1900·0. h m s	Decl. N. 1900·0. ° ′	Number of Plates.	π	π_c	P.E.
1326	...	11·2	6 9 16	44 56·8	4	+″·005	+″·008	±″·008
1327	...	11·2	6 9 17	44 16·7	4	−·004	−·001	±·011
1337	1276	10·3	6 9 26	45 17·9	6	+·008	+·015	±·006
1340	1277	9·3	6 9 28	45 5·7	7	+·020	+·022	±·006
1342*	1408	8·9	6 9 33	44 44·8	7	+·038	+·040	±·006
1346	...	10·6	6 9 35	44 9·0	4	−·025	−·022	±·010
1353	...	10·9	6 9 42	44 52·8	4	+·006	+·009	±·008
1354	...	11·0	6 9 47	44 37·4	5	−·022	−·019	±·009
1357	1409	10·5	6 9 49	44 37·0	7	+·002	+·007	±·006
1358	1280	9·9	6 9 49	45 19·3	6	+·005	+·013	±·006
1360	...	11·1	6 9 55	44 9·9	5	+·001	+·005	±·008
1361	...	11·2	6 9 56	44 32·7	4	−·014	−·011	±·007
1362	...	11·2	6 10 0	44 49·2	4	−·013	−·009	±·007
1363	...	10·7	6 10 2	45 15·6	5	−·014	−·009	±·006
1366	...	11·2	6 10 8	44 38·3	4	−·015	−·012	±·008
1374	1283	9·4	6 10 14	45 16·6	6	−·004	+·004	±·006
1377	1410	9·3	6 10 18	44 53·5	7	+·029	+·034	±·007
1395	...	10·6	6 10 45	44 14·2	5	−·003	+·002	±·007
1398	...	11·2	6 10 47	44 15·1	4	·000	+·002	±·012
1399	...	10·5	6 10 47	44 53·5	7	−·012	−·006	±·008
1402*	1409	11·3	6 10 51	44 36·4	4	+·004	+·008	±·008
1405	...	10·9	6 10 56	44 29·6	4	+·006	+·009	±·008
1408	1411	9·1	6 10 57	44 58·6	7	+·012	+·017	±·006
1411	...	10·5	6 10 59	44 21·0	4	+·024	+·028	±·007
1412	...	11·3	6 11 2	44 39·4	4	+·016	+·019	±·008
1420	...	10·7	6 11 10	44 17·1	5	+·001	+·004	±·008
1421	...	9·5	6 11 11	44 31·6	7	+·001	+·007	±·007
1436	1412	10·1	6 11 20	44 48·4	7	+·003	+·010	±·006
1439	1413	9·9	6 11 24	44 29·3	6	+·010	+·017	±·008
1444	1414	10·6	6 11 38	44 44·4	4	+·011	+·016	±·011
1448	...	10·2	6 11 42	44 52·1	5	−·008	−·003	±·009
1455	1415	8·7	6 11 58	44 39·1	5	+·008	+·011	±·008
1458	...	10·7	6 12 3	44 19·1	4	−·007	−·002	±·011
1463	...	10·6	6 12 9	45 6·2	4	−·014	−·006	±·009
1471	...	10·5	6 12 16	44 58·3	5	−·017	−·011	±·007

GROUP 6—*continued.*

No. in Radcliffe Catalogue of Parallaxes.	No. in B.D.	Photo. Magnitude.	R.A. 1900·0. h m s	Decl. N. 1900·0. ° ′	Number of Plates.	π	π_c	P.E.
						″	″	″
1474	...	10·4	6 12 19	45 12·9	4	− ·006	+ ·003	± ·007
1475*	1416	9·9	6 12 21	44 38·4	5	− ·002	+ ·006	± ·008
1476	...	10·6	6 12 23	44 33·1	5	− ·009	− ·003	± ·007
1477	1418	9·8	6 12 24	44 41·1	5	+ ·027	+ ·036	± ·008
1478	1417	10·6	6 12 25	44 36·3	5	+ ·012	+ ·019	± ·013
1482	...	11·0	6 12 32	44 37·5	4	+ ·007	+ ·012	± ·008
1489	...	10·7	6 12 39	44 51·4	4	− ·020	− ·017	± ·009

GROUP 7.

1607	1744	10·0	6 46 31	40 31·6	6	+ ·008	− ·001	± ·012
1614	*1745*	9·7	6 46 37	39 57·9	6	+ ·029	+ ·026	± ·013
1621*	1772	8·6	6 46 46	39 53·9	6	+ ·041	+ ·043	± ·011
1622	...	11·4	6 46 46	39 56·4	4	+ ·004	+ ·003	± ·011
1623	1746	10·1	6 46 48	40 21·5	6	− ·007	− ·013	± ·008
1624	...	10·9	6 46 48	40 41·8	4	+ ·012	+ ·008	± ·011
1625	...	11·2	6 46 49	40 13·2	4	− ·005	− ·006	± ·011
1632	...	11·4	6 47 0	39 52·3	4	+ ·033	+ ·033	± ·013
1633	...	11·5	6 47 0	40 4·3	4	− ·015	− ·014	± ·013
1637	...	10·8	6 47 6	40 1·9	5	+ ·027	+ ·024	± ·010
1643	...	10·9	6 47 13	40 41·5	4	− ·011	− ·015	± ·012
1646*	1776	10·2	6 47 18	39 47·0	4	+ ·071	+ ·061	± ·011
1648	...	11·3	6 47 19	40 26·8	4	+ ·010	+ ·008	± ·010
1658	1748	10·6	6 47 31	40 25·2	7	+ ·012	+ ·009	± ·007
1659	1747	10·6	6 47 32	40 15·6	7	+ ·009	+ ·008	± ·007
1662	...	12·0	6 47 37	40 31·9	4	− ·013	− ·011	± ·011
1671	...	10·8	6 47 43	40 36·0	6	+ ·027	+ ·024	± ·008
1672	...	11·5	6 47 44	39 49·8	4	+ ·026	+ ·029	± ·008
1676	...	11·6	6 47 46	39 56·5	5	− ·008	− ·007	± ·010
1682	...	12·0	6 47 50	40 6·1	4	− ·010	− ·009	± ·011
1685	...	12·0	6 47 52	40 8·0	4	− ·017	− ·015	± ·009
1686	...	11·4	6 47 52	40 14·4	5	+ ·019	+ ·019	± ·008
1690	...	11·6	6 47 54	40 2·4	5	− ·005	− ·004	± ·008
1693	...	11·5	6 47 55	40 36·1	4	− ·009	− ·009	± ·011
1694	1781	10·7	6 47 57	39 42·0	4	+ ·004	− ·001	± ·011

GROUP 7—*continued.*

No. in Radcliffe Catalogue of Parallaxes.	No. in B.D.	Photo. Magnitude.	R.A. 1900·0. h m s	Decl. N. 1900·0. ° ′	Number of Plates.	π	π_c	P.E.
1695	...	11·3	6 47 58	39 51·5	5	−″·002	−″·001	±″·009
1696	1749	10·6	6 47 58	40 22·1	7	+·004	+·001	±·008
1697	...	11·1	6 47 58	40 29·6	6	+·011	+·010	±·008
1699	1782	10·6	6 48 0	39 50·0	5	−·010	−·016	±·009
1700	...	11·4	6 48 1	40 31·5	5	−·004	−·002	±·008
1701	...	10·7	6 48 2	39 44·6	4	+·015	+·010	±·011
1703	...	11·8	6 48 3	39 47·5	4	−·013	−·008	±·010
1707	...	11·5	6 48 8	39 43·1	4	−·034	−·031	±·011
1708	1750	10·4	6 48 9	40 5·4	7	+·024	+·022	±·007
1709	1783	11·0	6 48 10	39 52·7	5	+·003	+·001	±·010
1710	....	11·2	6 48 10	40 3·8	5	+·025	+·025	±·008
1711	...	12·0	6 48 10	40 7·8	4	+·020	+·021	±·009
1714	...	10·8	6 48 13	40 27·9	7	−·007	−·009	±·008
1715	...	11·4	6 48 14	40 11·7	5	+·003	+·002	±·008
1718	...	11·1	6 48 21	40 33·7	6	+·028	+·027	±·008
1719*	1751	9·1	6 48 22	40 44·2	6	+·030	+·025	±·015
1720	...	11·1	6 48 22	39 55·8	5	+·002	+·002	±·008
1723	...	12·0	6 48 24	40 23·7	5	+·006	+·009	±·015
1728	....	11·6	6 48 28	40 17·9	5	−·004	−·003	±·009
1730	...	10·9	6 48 29	39 44·4	4	−·016	−·018	±·009
1731	1752	8·6	6 48 31	40 14·1	7	+·033	+·029	±·011
1737	...	11·5	6 48 33	39 56·8	5	−·028	−·027	±·013
1738	...	11·5	6 48 36	39 47·3	4	−·011	−·008	±·010
1739*	1753	8·2	6 48 36	40 41·4	6	+·021	+·025	±·020
1741	...	11·5	6 48 37	40 41·7	4	+·003	+·003	±·008
1745	1754	10·9	6 48 43	40 25·3	7	+·013	+·010	±·008
1751	...	11·8	6 48 48	40 0·4	5	−·022	−·020	±·012
1756*	1788	7·8	6 48 55	39 40·8	5	+·025	−·013	±·013
1760	...	10·8	6 49 0	39 44·3	4	+·015	+·011	±·009
1763	...	11·5	6 49 1	39 44·8	4	−·021	−·018	±·013
1766	1756	11·0	6 49 4	40 48·5	5	·000	−·002	±·010
1767	1756	10·7	6 49 4	40 48·1	5	+·022	+·022	±·008
1768	...	11·0	6 49 5	40 15·1	6	+·014	+·012	±·009
1773	...	11·8	6 49 10	40 16·5	5	−·024	−·023	±·013
1776	...	11·7	6 49 11	40 10·1	5	−·003	−·001	±·008

GROUP 7—*continued.*

No. in Radcliffe Catalogue of Parallaxes.	No. in B.D.	Photo. Magnitude.	R.A. 1900·0. h m s	Decl. N. 1900·0. ° ′	Number of Plates.	π	π_c	P.E.
1780	...	11·8	6 49 16	40 37·5	4	−″·018	−″·016	±″·009
1781*	1757	7·6	6 49 16	40 39·9	6	+·013	+·018	±·019
1783	...	10·8	6 49 17	39 46·5	4	+·014	+·010	±·011
1786	1789	11·2	6 49 18	39 50·0	4	+·013	+·013	±·012
1791	...	11·8	6 49 24	40 27·2	5	−·004	−·003	±·012
1796	...	10·7	6 49 28	40 42·8	6	+·014	+·011	±·007
1799*	1758	9·5	6 49 30	40 12·8	7	+·057	+·056	±·008
1800	...	11·4	6 49 31	40 13·4	5	+·029	+·030	±·011
1802	...	11·4	6 49 32	40 10·5	5	+·004	+·005	±·008
1805	1791	10·5	6 49 35	39 52·1	7	·000	−·005	±·010
1807	1759	9·5	6 49 37	40 12·1	7	+·014	+·013	±·009
1810	...	11·9	6 49 37	40 32·3	4	+·014	+·016	±·010
1819	...	12·0	6 49 43	40 22·3	4	+·002	+·005	±·008
1824	...	11·1	6 49 49	39 54·2	5	+·001	−·001	±·008
1825	...	11·4	6 49 49	40 23·5	5	+·009	+·009	±·008
1834	...	11·1	6 49 57	39 53·7	5	+·007	+·006	±·009
1835	...	11·7	6 49 57	40 11·2	5	−·027	−·025	±·011
1836	...	11·0	6 49 59	40 19·2	5	·000	·000	±·009
1846	*1760*	8·8	6 50 6	39 59·3	7	+·031	+·026	±·015
1848	...	12·0	6 50 6	40 34·2	4	−·022	−·019	±·013
1850	...	11·7	6 50 8	40 14·4	5	−·024	−·021	±·009
1851	...	10·7	6 50 8	40 28·1	7	+·007	+·003	±·007
1852	...	11·6	6 50 8	40 42·6	4	+·018	+·019	±·012
1859	...	11·7	6 50 13	39 52·1	4	−·006	−·003	±·013
1860	...	10·8	6 50 13	40 9·2	6	−·024	−·027	±·008
1864	...	11·8	6 50 19	40 8·7	5	−·015	−·014	±·013
1865	...	11·5	6 50 20	40 39·8	4	−·017	−·017	±·008
1866	...	12·0	6 50 21	40 35·4	4	·000	+·003	±·008
1872	...	11·5	6 50 24	40 45·7	4	+·019	+·020	±·011
1874	...	11·7	6 50 27	39 51·0	4	−·001	+·003	±·009
1879	...	11·8	6 50 30	40 19·2	5	·000	+·001	±·010
1880	...	11·2	6 50 31	39 47·3	4	+·002	+·002	±·009
1887	...	12·0	6 50 38	40 21·9	5	−·013	−·011	±·009
1889	...	11·8	6 50 40	40 27·8	5	+·011	+·013	±·008
1890	...	11·1	6 50 40	40 40·0	4	−·010	−·011	±·008

GROUP 7—*continued.*

No. in Radcliffe Catalogue of Parallaxes.	No. in B.D.	Photo. Magnitude.	R.A. 1900·0. h m s	Decl. N. 1900·0. ° ′	Number of Plates.	π	π_c	P.E.
1896	...	11·9	6 50 46	40 0·6	4	−″·007	−″·006	±″·009
1897	1761	10·2	6 50 46	40 34·0	7	+ ·018	+ ·015	± ·008
1899	...	10·8	6 50 48	40 17·3	7	+ ·001	− ·003	± ·008
1901	...	12·1	6 50 52	40 36·5	4	+ ·008	+ ·010	± ·008
1903	...	11·9	6 50 54	40 8·6	4	+ ·001	+ ·002	± ·012
1905	1794	10·5	6 50 55	39 41·8	5	+ ·001	− ·005	± ·012
1910	...	11·2	6 50 58	40 46·4	5	+ ·008	+ ·007	± ·008
1912	1795	10·9	6 50 59	39 51·2	6	− ·009	− ·013	± ·008
1916	...	11·5	6 51 1	39 48·5	4	− ·020	− ·018	± ·009
1919	...	11·4	6 51 3	40 5·1	5	+ ·013	+ ·012	± ·009
1920	...	11·2	6 51 4	39 57·2	5	− ·002	− ·004	± ·008
1921	1762	9·2	6 51 4	40 10·2	7	+ ·018	+ ·020	± ·009
1924	1763	10·6	6 51 6	40 14·5	7	+ ·001	− ·002	± ·008
1942	1764	10·4	6 51 22	40 33·4	6	+ ·001	·000	± ·008
1955	1765	10·6	6 51 39	40 19·5	6	+ ·028	+ ·026	± ·008
1957	...	11·5	6 51 40	40 30·0	4	− ·030	− ·028	± ·009
1967	...	11·5	6 51 52	39 53·4	4	− ·013	− ·011	± ·009
1970*	1799	6·8	6 51 56	39 40·2	4	+ ·008	− ·042	± ·017
1977	...	11·5	6 52 1	39 59·4	4	− ·028	− ·027	± ·009
1979	1801	9·1	6 52 2	39 54·8	6	+ ·021	+ ·020	± ·011
1988	...	11·4	6 52 9	40 10·8	4	− ·004	− ·002	± ·010
1996	...	11·7	6 52 15	40 0·5	4	+ ·033	+ ·036	± ·011
1998	...	11·7	6 52 16	40 7·1	4	- ·008	− ·005	± ·013
2001	...	11·6	6 52 21	40 19·7	4	+ ·001	+ ·004	± ·010
2012	...	10·8	6 52 33	40 28·9	5	− ·009	− ·009	± ·009
2019	1766	10·6	6 52 37	40 11·0	4	− ·003	− ·003	± ·008

GROUP 8.

2133	...	10·5	6 51 52	48 20·6	3	− ·017	− ·014	± ·017
2139*	1460	7·9	6 52 5	48 45·5	3	+ ·112	+ ·044	± ·016
2142	...	10·5	6 52 11	48 46·4	3	- ·006	− ·005	± ·014
2144	1461	10·3	6 52 19	48 14·1	3	+ ·001	+ ·002	± ·011
2145	1577	10·2	6 52 20	49 0·9	3	− ·041	− ·040	± ·015

GROUP 8—*continued.*

No. in Radcliffe Catalogue of Parallaxes.	No. in B.D.	Photo. Magnitude.	R.A. 1900·0. h m s	Decl. N. 1900·0. ° ′	Number of Plates.	π	π_c	P.E.
2146	...	11·1	6 52 39	48 0·9	3	−″·026	−″·021	±″·012
2154	1578	9·6	6 52 51	49 1·6	3	− ·004	− ·010	± ·015
2156	1462	10·3	6 52 52	48 6·2	3	+ ·004	+ ·005	± ·023
2158	...	10·8	6 52 55	48 17·8	3	− ·023	− ·018	± ·018
2159	1463	10·0	6 52 59	48 42·2	3	+ ·003	+ ·002	± ·014
2163*	1464	8·5	6 53 6	48 36·8	3	+ ·067	+ ·034	± ·018
2165*	1465	8·6	6 53 11	48 19·1	3	+ ·060	+ ·024	± ·014
2166	...	10·7	6 53 13	48 35·5	3	− ·032	− ·027	± ·012
2167	1466	9·2	6 53 16	48 5·5	3	+ ·025	+ ·012	± ·013
2169	...	10·6	6 53 21	48 22·1	3	+ ·035	+ ·040	± ·016
2170	1467	9·8	6 53 23	48 36·3	3	− ·004	− ·006	± ·017
2171	...	10·3	6 53 26	48 3·1	3	− ·011	− ·008	± ·012
2180	1468	10·1	6 53 46	48 51·0	3	− ·002	·000	± ·013
2185*	1469	8·4	6 54 0	48 31·8	3	+ ·101	+ ·058	± ·012
2187	...	10·7	6 54 8	48 30·6	3	− ·038	− ·033	± ·012
2189	...	11·0	6 54 17	48 6·8	3	+ ·009	+ ·014	± ·014
2193	1470	10·4	6 54 31	48 35·4	3	− ·008	− ·007	± ·016
2198	...	10·6	6 54 50	48 26·7	3	− ·014	− ·011	± ·015
2203	...	10·5	6 55 16	48 35·0	3	− ·030	− ·027	± ·012

GROUP 9.

2277	1576	9·3	7 44 18	30 54·0	6	− ·033	− ·019	± ·008
2279	1578	9·8	7 44 23	30 25·2	4	+ ·052	+ ·058	± ·008
2286*	1581	8·6	7 44 44	30 31·0	4	+ ·031	+ ·040	± ·012
2287	...	10·8	7 44 48	30 37·6	5	− ·009	− ·009	± ·011
2288	...	10·8	7 44 50	30 33·4	5	+ ·035	+ ·035	± ·009
2290	...	10·9	7 45 2	31 2·0	5	+ ·011	+ ·012	± ·011
2295	...	10·3	7 45 11	30 40·6	6	− ·011	− ·006	± ·008
2296	*1678*	9·9	7 45 11	30 55·3	6	+ ·005	+ ·012	± ·006
2297*	1583	7·6	7 45 12	30 47·1	6	− ·024	+ ·005	± ·010
2298	...	10·7	7 45 13	30 57·0	5	− ·013	− ·011	± ·008
2299	...	10·9	7 45 16	30 42·1	4	+ ·003	+ ·004	± ·011
2300	...	10·8	7 45 18	31 6·1	5	− ·017	− ·015	± ·008
2303	...	10·5	7 45 26	31 19·8	4	− ·005	+ ·001	± ·011
2305	1585	9·7	7 45 33	30 30·1	5	+ ·022	+ ·025	± ·011
2306	1584	10·6	7 45 35	30 35·5	7	+ ·017	+ ·020	± ·008

GROUP 9—*continued.*

No. in Radcliffe Catalogue of Parallaxes.	No. in B.D.	Photo. Magnitude.	R.A. 1900·0. h m s	Decl. N. 1900·0. ° ′	Number of Plates.	π	π_c	P.E.
						″	″	″
2308	1586	10·4	7 45 39	30 42·7	7	+·007	+·011	±·011
2309	...	10·2	7 45 40	30 58·0	7	−·018	−·013	±·008
2317	...	11·0	7 46 0	30 56·9	5	−·022	−·018	±·011
2318	...	11·1	7 46 3	31 16·8	4	−·020	−·016	±·013
2322	1680	9·7	7 46 14	31 28·8	4	+·018	+·024	±·011
2328	...	11·1	7 46 29	31 16·6	4	−·016	−·012	±·011
2329	...	10·7	7 46 33	31 15·7	6	−·006	−·006	±·009
2330	1591	9·4	7 46 35	30 25·5	5	+·002	+·006	±·008
2331	1682	10·7	7 46 41	31 9·9	6	+·001	+·003	±·007
2332	1592	9·7	7 46 45	30 38·1	7	+·015	+·023	±·007
2334	...	11·1	7 47 6	30 27·7	4	+·005	+·010	±·013
2335*	*1684*	8·3	7 47 10	30 54·8	7	+·023	+·036	±·012
2336	1593	10·8	7 47 15	30 44·4	7	+·012	+·013	±·007
2338	1596	10·1	7 47 24	30 33·5	7	−·004	·000	±·008
2339	1597	10·8	7 47 26	30 41·3	6	+·021	+·022	±·008
2340	*1686*	10·3	7 47 27	30 56·6	7	−·004	+·001	±·008
2342	1687	9·9	7 47 37	31 18·3	4	−·010	−·003	±·011
2343	...	11·0	7 47 41	30 43·4	6	−·025	−·024	±·012
2345	1688	9·4	7 47 51	31 4·3	7	+·018	+·024	±·008
2347	...	10·7	7 47 56	31 13·0	6	−·018	−·015	±·008
2348	1689	9·9	7 48 6	31 16·1	7	·000	+·007	±·008
2349	1600	10·5	7 48 10	30 36·7	7	−·003	·000	±·008
2350	1599	10·7	7 48 10	30 44·4	7	+·004	+·007	±·008
2351	...	11·0	7 48 14	31 27·4	4	+·048	+·052	±·008
2353*	1690	8·9	7 48 17	31 15·1	7	+·014	+·021	±·010
2354	...	10·3	7 48 21	30 20·1	5	−·016	−·012	±·010
2355	...	10·8	7 48 27	30 28·8	5	−·005	·000	±·013
2356	1691	10·6	7 48 27	31 11·6	6	+·026	+·029	±·010
2357*	1601	8·4	7 48 29	30 36·2	7	+·022	+·037	±·011
2359	1692	10·4	7 48 31	31 21·6	4	+·031	+·036	±·010
2361	1602	10·1	7 48 38	30 49·8	7	+·009	+·014	±·007
2362	1693	9·7	7 48 39	31 2·5	7	+·010	+·016	±·008
2363	...	10·6	7 48 41	30 38·5	6	−·003	−·001	±·011
2364	1694	9·6	7 48 41	31 7·1	7	·000	+·006	±·008
2366	1603	10·6	7 48 46	30 32·7	6	−·009	−·009	±·010

GROUP 9—*continued.*

No. in Radcliffe Catalogue of Parallaxes.	No. in B.D.	Photo. Magnitude.	R.A. 1900·0.	Decl. N. 1900·0.	Number of Plates.	π	π_c	P.E.
			h m s	° ′		″	″	″
2368	...	10·7	7 48 51	30 38·8	6	−·015	−·016	±·011
2369	1604	10·6	7 48 54	30 33·0	6	−·001	−·001	±·012
2372	...	10·9	7 49 0	30 42·8	5	−·006	−·007	±·011
2375	1606	10·5	7 49 3	30 32·7	6	+·002	+·004	±·010
2377	...	10·6	7 49 4	30 38·3	6	−·004	−·004	±·009
2379	1607	9·8	7 49 9	30 31·2	4	−·003	−·002	±·013
2383*	1608	9·2	7 49 15	30 50·0	5	+·005	+·023	±·009
2385	*1697*	10·7	7 49 17	30 59·9	5	−·003	−·003	±·009
2386	...	10·8	7 49 18	31 5·8	5	+·016	+·015	±·011
2390*	1610	8·9	7 49 26	30 37·2	6	·000	+·013	±·010

Notes.

89. μ_α, $-0^s·0151$; μ_δ, $-0''·837$ (Porter): π, $+0''·014$ (*Gron.*, 24). Spectrum, F2.
90. Spectrum, F5.
104. There is a close companion at P.A. 265°; magnitude about 13.
380. Nova Persei. P.M. insensible (Barnard, *Ast. Nach.*, 4220). π, $+0''·011$ (*Gron.*, 24).
401. Spectrum, Ma.
452. Spectrum, Mb.
658–9. Σ 443. Only a single parallax plate was secured of this region. A paper entitled "A Photographic Determination of the Proper Motion of 250 Stars in the Neighbourhood of Σ 443," by Dr. Rambaut, will be found in the *M.N.*, **73**. The proper motions deduced in that paper for Σ 443 (mean) are μ_α, $+0^s·0521$; μ_δ, $-1''·229$. Spect. π, 658, $0''·035$; 659, $0''·032$; trig. π, 658–659, $0''·030$ (*Ap. J.*). Combined spectrum, G5.
757. μ_α, $+0^s·0079$; μ_δ, $-0''·029$: π, $+0''·004$ (*Gron.*). Spectrum, G5.
760. μ_α, $-0^s·0012$; μ_δ, $-0''·047$ (*Gron.*).
763. μ_α, $0^s·0000$; μ_δ, $-0''·022$: π, $-0''·022$ (*Gron.*). Spectrum, B8.
768. μ_α, $+0^s·0042$; μ_δ, $-0''·045$: π, $+0''·003$ (*Gron.*). Spectrum, G5.
771. μ_α, $+0^s·0070$; μ_δ, $-0''·021$: π, $-0''·015$ (*Gron.*).
774. μ_α, $-0^s·0022$; μ_δ, $-0''·071$: π (single plate), $+0''·044$ (*Gron.*).
777. μ_α, $+0^s·0064$; μ_δ, $-0''·038$: π, $+0''·005$ (*Gron.*). Spectrum, F8.
967. A comparison with *Oeltzen's Argelander* shows that the proper motions are small.
994. μ_α, $-0^s·0590$; μ_δ, $+0''·110$ (Porter). Spectrum, Ko. Spect. π, $0''·048$; trig. π, $0''·036$ (*Ap. J.*).
1003. Spectrum, Ao.
1046. A very faint companion *nf.*, distance about 5″.
1053. Spectrum, A2.
1179. Images slightly elongated. It appears to be a close double, P.A. 90° or 270°.
1200. Spectrum, Ko.
1232. Spectrum, A5.
1342. μ_α, $-0^s·0230$; μ_δ, $-0''·330$ (Porter). Spectrum, Ko. Spect. π, $0''·036$. In *Ap. J.*, 53, 13, the parallax, $+0''·102$, is erroneously attributed to this star.

1402. The magnitude given in the B.D. is 9·4.
1475 Elongated images; P.A. 0° or 180°. Probably a close double.
1621 and 1646. A comparison of the Astrographic and A.G. Catalogues shows that the proper motions of both these stars are small.
1719. Spectrum, A2.
1739. Spectrum, A0.
1756. Spectrum, A0.
1781. Spectrum, F5.
1799. μ_α, $+0^s\cdot0110$; μ_δ, $-0''\cdot410$ (Porter). Spectrum, K4, *Ap. J.*, 53, 13. Spect. π, $0''\cdot063$ (*Ap. J.*).
1970. Spectrum, A0.
2133–2203. Only three plates were secured in this Group. All stars common to the three plates which are without a qualifying note by the measurer have been included in the present paper.
2139. Spectrum, K0.
2163. Spectrum, G0.
2165. Spectrum, G5.
2185. μ_α, $+0^s\cdot0554$, μ_δ, $-0''\cdot427$ (Porter). Spectrum, K0. Spect. π, $0''\cdot048$; trig. π, $0''\cdot032$ (*Ap. J.*).
2286. Spectrum, G5.
2297. Spectrum, B9.
2335. μ_α, $+0^s\cdot0570$; μ_δ, $-1''\cdot820$ (Porter). Spectrum, G0. Spect. π, $0''\cdot020$; trig. π, $0''\cdot055$ (*Ap. J.*).
2353. Spectrum, F0.
2357. Spectrum, G5.
2383. Spectrum, G5.
2390. μ_α, $-0^s\cdot0089$; μ_δ, $-0''\cdot074$ (*Greenwich Catalogue*, 1910, part ii., 4036). Spectrum, G0.

Further Note on the Comparison of Trigonometric Parallaxes with Spectroscopic. By H. H. Turner, D.Sc., F.R.S., Savilian Professor.

In the March number attention was drawn to certain small differences of a systematic nature between the trigonometric parallaxes (T) determined at the Leander M'Cormick Observatory and the spectroscopic parallaxes (S) inferred at Mount Wilson. Hypotheses were considered on which the error might originate in either S or T, the conclusion finally indicated in a note (added on March 24) being that the source of discrepancy lay with T. This added note was suggested by the appearance of Adams's 1646 parallaxes (*Ap. J.* for January) a rapid analysis of which showed that there was no systematic difference S – T *in general* of the kind under notice. But I have since realised that this list gave us something more: viz. a revised series of S parallaxes based on revised working curves: and that it is this revision which is responsible, at any rate in great part, for the disappearance of the progressive change in S – T. In other words, if we revise the comparison of S and T given in the Leander M'Cormick volume by substituting corrected values of S for those therein used, the differences S – T become satisfactorily constant for all values of S, and no longer show the progressive change previously mentioned.

This work has not actually been done in this form; but it is easy to pick out the M (Leander M'Cormick) parallaxes from Adams's 1646 list and thus get an equivalent.

There is thus no need to call on either of the hypotheses outlined in the former note. The discordance to be explained has disappeared in the revision, and S and T are now satisfactorily in accord—due allowance being made for the constant error in T arising from the average parallax of a comparison star. This accordance has a double significance. On the one hand it supports Mr. S. A. Mitchell's expressed belief that his Leander M'Cormick parallaxes (T) are sensibly free from systematic error, and on the other it gives good assurance that Mr. W. S. Adams's working curves for inferring parallaxes (S), which were necessarily formed by a series of approximations—"trial and error"—are approaching final shape, if indeed they have not already attained it.

It seems desirable that this recognition should appear in the same volume of the *Monthly Notices* which contained the note calling in question the freedom from error of one or other of the methods; and I will venture to add a word of admiration for the great advance in our knowledge of the distances of the stars rendered conspicuous by this beautiful accordance of the two methods.

The Spiral Nebulæ in the Zone $-40°$ *to* $-90°$ *(from the Franklin-Adams Plates).* By J. H. Reynolds.

Owing to the large photographic reflectors being (with two exceptions) confined geographically to the northern hemisphere, no systematic work has yet been undertaken in the direction of photographing the spirals in the Zone $-40°$ to $-90°$. The 30-in. reflector of the Helwân Observatory has been employed for many years in photographing the Zone $0°$ to $-40°$, and a fairly complete record of the larger spirals in this area has now been obtained by Mr. H. Knox Shaw and Mr. C. L. Gregory. In certain cases spirals situated a little further south than $-40°$ have been photographed at this observatory.

As the lack of information as to the spirals in a considerable area surrounding the South Pole is a great drawback in any studies of their general distribution and size, a re-examination of the Franklin-Adams plates of this region has been undertaken by the writer with the kind permission of the Astronomer Royal.

A preliminary examination of these was made by Mr. J. A. Hardcastle in 1913 (*M.N.*, 74, 699), in connection with a general survey of the nebulæ appearing on the complete series of plates, but only in exceptional cases were details of the various objects given beyond their identification in the *N.G.C.* A certain number of inaccuracies in this list have been found, some of the objects classified as spirals being undoubtedly either of other types or

globular clusters, while others cannot be identified on the plates at all. In the area dealt with in this paper, however, there are only a few objects cited to which exception can be taken.

The character of the plates makes it difficult to give adequate descriptions of the spirals found, and in the following list the dimensions given can only be taken as an approximation. It may be safely predicted, however, that when the objects are photographed on a larger scale with reflectors, the dimensions given will be found to be rather under- than over-stated. The size of the plates is 39 cm. square, each containing 225 square degrees, and the scale is 1 mm. = 3′.

Owing to the large area covered by each plate, the definition falls off rather rapidly towards the edges and especially the corners of the plates, and with objects so situated the distortion is so great that it is impossible to say more than that the object is a nebula and not a star image. Altogether 43 plates covering the area were examined.

Although most of the objects included in the list are definitely of the spiral type, a few are included which cannot be strictly termed spirals, although they are allied as far as spectrum and distribution are concerned. For example, *N.G.C.* 1433 and 1512 each consist of a bright nucleus with an oval ring of composite formation and a bright band crossing the ring in the direction of the major axis. These are similar to the objects described in *Pub. L.O.*, **13**, as ϕ type, but have no spiral arms. Other examples are *N.G.C.* 1350 (*Helwân Bull.*, 15) and *N.G.C.* 4725 (Isaac Roberts, vol. ii.). The class termed "globular" nebulæ in the Helwân Bulletins is not included, as these are usually under 3′ diameter, and their character in the Franklin-Adams plates cannot be definitely placed. There is no doubt that many examples of this type will be found to exist in the south polar regions. A nondescript object is *N.G.C.* 5128, which was placed by Hardcastle amongst the spirals. There is a round diffuse nebulosity, 6′ in diameter, cut in two by a double band of absorption, bearing some resemblance to the absorption band appearing in spirals of which the planes are almost in the line of sight. This nebula has been photographed at Helwân with the 30-in. reflector, and is described by Gregory in Bulletin 21 (now in the press) as "possibly gaseous," with which the writer agrees. It has therefore been omitted.

One cannot but be struck in an investigation of this area of sky by the evident grouping together of spirals of the same type. In an area of a square degree at $\alpha = 23^h\ 15^m$, $\delta = -43°$, there are four spirals almost of equal size and of equal inclination to the line of sight. Some plates contain a large number of examples, while others, equally removed from the Galactic Equator, show none at all. A group of bright large spirals lies to the north-east of the Greater Magellanic Cloud, while a group of what appear to be globular nebulæ lies to the south of it. A fuller investigation of the distribution and size of the spirals is being undertaken by the writer in connection with a general catalogue of spiral nebulæ, but

this grouping in size and character seems to be one of the chief features of their distribution.

The Galactic Equator cuts the small circle $-40°$ at R.A. $8^h\ 25^m$ and $17^h\ 10^m$, and passes within 27° of the South Pole in R.A. $12^h\ 47^m$. Three of the objects listed are in the North Galactic Hemisphere, including *N.G.C.* 4945, which is $12' \times 2'$, and only 13° from the Galactic Equator. Both this and *N.G.C.* 6300 (Galactic Latitude $-12°$) are situated in rich star fields.

The following spirals call for special description on account of their size:—

N.G.C. 1546.* $\alpha = 4^h\ 12^m$, $\delta = 57°\ 55'$. Bright irregular mass with no spiral structure, but no doubt of the spiral class.

N.G.C. 1553. Bright oval nucleus, $3' \times 2'$, surrounded by faint haze.

N.G.C. 1566. Large, bright, S-shaped, with very bright nucleus.

N.G.C. 1672. Irregular, S-shaped, with considerable hazy extension.

N.G.C. 2442. S-shaped, irregular.

N.G.C. 4945. Unusual type, complicated irregular ring, much inclined to line of sight with no nucleus, the south-western half being very faint.

N.G.C. 6744. Faint, large, almost at right angles to line of sight, small nucleus.

N.G.C. 6943. Bright spindle, no structure visible.

N.G.C. 7090. Bright, well-defined spindle.

N.G.C. 7141. Spindle, no detail visible.

N.G.C. 7410. Spindle with bright nucleus.

N.G.C. 7412. Open, well-defined spiral.

N.G.C. 7456. Faint spindle.

The identification of *N.G.C.* objects on the Franklin-Adams plates is sometimes difficult, owing to apparent differences in position, but no attempt has been made to rectify the places given in the *N.G.C.* except where there is an obvious error. In most cases these positions depend on Sir John Herschel's observations at the Cape, which were not free from accidental errors, owing to the type of instrument and mounting employed.

There is some confusion as to the two objects appearing in the *N.G.C.* under the numbers 1510 and 1512. The latter is described therein as a bright, fairly large globular cluster, but there is no such object at the place named, which is very near 1510. The nebula which appears near the position of 1510 has already been mentioned above as bright, large, and of an unusual type, and no other object can be seen on the Franklin-Adams plate. Gregory at Helwân, however, identifies a globular nebula (not a cluster) in this region with 1510; he describes it as small, bright, and round, the larger nebula being identified as 1512.

* Identification with *N.G.C.* 1546 doubtful.

In cases where the objects have been photographed at Helwân with the 30-in. reflector, this is indicated by H.O.B. Some of these results have not yet been published.

N.G.C. No.	1900 α	1900 −δ	λ	β	Dim.	P.A.	Description.
	h m s	° ′	°	°	′ × ′	°	
406	1 4 1	70 25	267	−47	2 × 1	25	F
625	1 30 41	41 57	242	−73	2·5 × 1	95	F (H.O.B.)
1249	3 7 10	53 43	238	−53	2 × 1	70	
1313	3 17 2	66 51	250	−46	4 × 2	5	Ext.
1433	3 38 53	47 33	228	−51	5 × 3		! ring B stellar N, no spiral arms
1448	3 40 24	44 57	220	−51	5 × 1	35	BN
*1511	3 59 11	68 54	251	−39	4 × 2	121	B
1512	4 0 38	43 37	216	−48	3 × 2·5		! resembles 1433 (H.O.B.)
1515	4 1 37	54 22	231	−46	5 × 1·5	15	BN
1527	4 5 28	48 9	224	−46	4 × 2	80	pB
1553	4 14 2	56 2	232	−43	6 × 2·5	135	B
1558	4 16 10	45 16	218	−46	3 × 1	90	pB
1559	4 16 24	63 2	242	−40	3 × 2		Irr.
1566	4 17 45	55 11	231	−42	6 × 3		! B
1602	4 25 46	55 17	230	−43	2 × 1	80	pB
1617	4 29 26	54 49	230	−41	3 × 1·5	80	pB
1672	4 44 9	59 26	236	−38	6 × 4		B, S type
1771	4 58 8	63 17	234	−37	1 × 0·5		F
2442	7 36 38	69 17	248	−22	6 × 3	39	B irr., S type
4835	12 52 30	45 43	271	+18	3 × 1	140	F
4945	12 59 32	48 45	272	+13	12 × 2	49	! Irr. oval ring, no N
5483	14 4 14	42 50	285	+18	2 × 1·5		F
6300	17 7 35	62 42	298	−12	4 × 2	130	F in dense field, star images poor
6707	18 47 16	53 55	312	−21	3 × 1	130	F
6744	19 0 16	64 1	298	−26	12 × 10		! F, BN
6769	19 10 28	60 40	303	−26	3 × 2		
6872	20 6 20	71 4	291	−32	2 × 1		F, 4 sn near
6887	20 9 41	53 5	312	−34	5 × 2	90	Largest of 3
6902	20 17 38	43 9	324	−34	2 × 1		
6909	20 20 34	47 22	318	−35	3 × 1	20	BN
6943	20 34 57	69 6	291	−34	7 × 1	130	B

* The N.P.D. given in the *N.G.C.* seems to be a degree too great.

N.G.C. No.	1900 α h m s	1900 −δ ° ′	λ °	β °	Dim. ′ × ′	P.A. °	Description.
7038	21 8 22	47 38	317	−42	4×2	110	F, BN
7059	21 19 46	60 27	302	−42	4×2	120	
7064	21 21 57	53 13	312	−44	5×1	95	pB
7083	21 27 51	64 21	296	−40	3×1·5	10	
7090	21 29 26	55 1	307	−45	8×1	130	!B
7098	21 36 7	75 34	283	−36	3×2		
7107	21 35 56	45 15	322	−47	3×2		F
7124	21 41 25	51 2	314	−47	3×1	130	F
7125	21 41 54	61 10	300	−43	4×2	85	BN
7141	21 45 17	56 2	306	−46	4×2		F
7162	21 53 18	43 48	322	−51	3×1		F
7179	21 57 22	64 32	293	−42	3×1	45	
7307	22 27 54	41 28	325	−58	4×1	90	F
7368	22 39 50	39 53	324	−60	3×1	130	F
7410	22 49 19	40 11	324	−62	4×1	45	BN (H.O.B.)
7412	22 50 4	43 11	315	−60	3×2		BN, S type (H.O.B.)
7424	22 51 38	41 37	323	−61	6×6		F well-defined spiral (H.O.B.)
7456	22 56 30	40 7	322	−64	6×1	20	F irr. (H.O.B)
7462	22 57 12	41 22	323	−64	3×1	85	F, BN
7496	23 4 11	43 57	316	−62	4×2		BN
7582	23 12 53	42 40	320	−65	4×1·5	90	BN
7599	23 13 40	42 48	318	−66	4×2	90	BN (H.O.B.)
II 1954	3 28 52	52 15	232	−49	3×1·5		F
II 1970	3 33 6	44 17	220	−52	3×1	70	pB
II 4720	18 24 28	58 28	302	−20	3×1·5	160	F
II 4721	18 25 42	58 34	302	−21	4×2		F, BN
II 4810	18 54 36	56 18	309	−23	4×2		BN
II 4837	19 7 12	54 50	309	−24	3×2		F
II 5052	20 42 36	69 35	291	−34	6×1	130	pB
II 5152	21 56 12	51 46	313	−50	4×2	90	F

On Critical Terms associated with the Libration.
By Dr. J. Woltjer, Jr.

(*Communicated by Prof. W. de Sitter.*)

Introduction.—In the theory of Hyperion terms arise in the longitude of the satellite with arguments nearly equal to the argument of the libration, and with coefficients that contain the square root of the perturbing mass (Titan) as a divisor; these terms are factored by the eccentricity of the orbit of Titan. In this note I shall point out the origin of these remarkable critical terms with the aid of Delaunay's transformation adapted to the case of libration.

§ 1. Let the system of differential equations to be integrated be:

$$(1) \qquad \frac{dx_i}{dt} = \frac{\partial F}{\partial y_i} \qquad \frac{dy_i}{dt} = -\frac{\partial F}{\partial x_i} \qquad i = 1, \ldots, n;$$

F = a sum of cosine-terms; the arguments are linear functions of $y_1 \ldots y_n$ with integral coefficients, to each of which may be added a known linear function of the time t.

I suppose the argument y_1 to be subject to libration. The object of the first Delaunay-transformation is to remove the terms with arguments equal to an integral multiple of y_1 from the function F. To obtain the necessary equations connecting the old and the new variables, I restrict the function F to the terms just mentioned and solve the equations (1). The solution will be:

$$(2) \qquad \begin{aligned} x_1 &= \sum_0^\infty {}^p \kappa_p^{(1)} \cos p\eta_1 & y_1 &= \sum_1^\infty {}^p \epsilon_p^{(1)} \sin p\eta_1 \\ x_2 &= \xi_2 & y_2 &= \eta_2 + \sum_1^\infty {}^p \epsilon_p^{(2)} \sin p\eta_1 \\ &\ldots\ldots\ldots\ldots\ldots\ldots & & \\ x_n &= \xi_n & y_n &= \eta_n + \sum_1^\infty {}^p \epsilon_p^{(n)} \sin p\eta_1 \end{aligned}$$

$$\eta_k = \nu_k t + \gamma_k, \qquad k = 1, \ldots, n;$$

$\kappa_p^{(1)}$, $\epsilon_p^{(k)}$, ν_k are functions of n constants of integration $\xi_1 \ldots \xi_n$; $\gamma_1 \ldots \gamma_n$ are n other constants of integration.

The librational character of the solution is expressed by the omission of the argument η_1 in the expression for y_1.

If we consider these equations as equations of transformation connecting the variables $x_1 \ldots x_n$, $y_1 \ldots y_n$ with the variables $\xi_1 \ldots \xi_n$, $\eta_1 \ldots \eta_n$, the differential equations in the new variables will be:

$$(3) \qquad \frac{d\xi_i}{dt} = \frac{\partial F}{\partial \eta_i} \qquad \frac{d\eta_i}{dt} = -\frac{\partial F}{\partial \xi_i},$$

provided the constant of integration ξ_1 in the solution (2) has been so chosen that

$$(4)\quad \xi_1 = \tfrac{1}{2}\{\kappa_1^{(1)}\epsilon_1^{(1)} + 2\kappa_2^{(1)}\epsilon_2^{(1)} + 3\kappa_3^{(1)}\epsilon_3^{(1)} + \ldots + p\kappa_p^{(1)}\epsilon_p^{(1)} + \ldots\}.$$

If this condition is not fulfilled it will be easy to introduce a new constant of integration satisfying this condition.

These formulæ of transformation are analogous to those of Delaunay (*Théorie du Mouvement de la Lune*, i. § 29).

§ 2. The condition (4) may be written:

$$\xi_1 = \frac{1}{2\pi}\int_0^{2\pi} x_1 \frac{\partial y_1}{\partial \eta_1} d\eta_1 = \text{mean value of } x_1 \frac{\partial y_1}{\partial \eta_1}.$$

Since

$$\frac{1}{2\pi}\int_0^{2\pi} x_1 \frac{\partial y_1}{\partial \eta_1} d\eta_1 = \left[\frac{x_1 y_1}{2\pi}\right]_0^{2\pi} - \frac{1}{2\pi}\int_0^{2\pi} y_1 \frac{\partial x_1}{\partial \eta_1} d\eta_1,$$

the condition for ξ_1 is

$$\xi_1 = -\text{mean value of } y_1 \frac{\partial x_1}{\partial \eta_1},$$

or, as

$$\frac{\partial x_1}{\partial \eta_1} = \frac{1}{\nu_1}\frac{\partial x_1}{\partial t} = \frac{1}{\nu_1}\frac{\partial F_1}{\partial y_1},$$

where F_1 is the restricted function F

$$\xi_1 = -\text{mean value of } \frac{y_1}{\nu_1}\frac{\partial F_1}{\partial y_1}.$$

The function $\dfrac{\partial F_1}{\partial y_1}$ is an uneven function of y_1; thus, if the libration is small, we may be satisfied with the first term of the series:

$$(5)\quad \xi_1 = -\frac{\overline{y_1^2}}{\nu_1}\left[\frac{\partial^2 F_1}{\partial y_1^2}\right]_{y_1=0} + \ldots;$$

here the line above the symbol y_1^2 denotes its mean value.

§ 3. The transformation (2) removes from the function F all terms with arguments equal to an integral multiple of y_1.

To illustrate the manner in which the critical terms mentioned may arise, let y_2 be a secular argument.

Consider the terms

$$(6)\quad A\cos(y_1 + y_2).$$

If we substitute the new variables, this term becomes

$$A\cos y_2 \cos y_1 - A\sin y_2 \sin y_1 = A\cos y_2\left\{1 - \frac{y_1^2}{2} + \ldots\right\} - A\sin y_2\{y_1 \ldots\},$$

or

$$7)\quad = \ldots - \frac{\overline{y_1^2}}{2} A\cos y_2 + \ldots,$$

if we omit the terms arising from combination of the arguments y_2 and η_1 and also the term $A \cos y_2$ independent of the librational constant.

The term in question may be written, according to (5):

$$- \ . \ . \ . + \frac{\nu_1 \xi_1}{\left[\frac{\partial^2 F_1}{\partial y_1^2}\right]_{y_1=0}} \frac{A}{2} \cos y_2 + \ . \ . \ . \ .$$

The new differential equations for ξ_1 η_1 will be, as far as this term is concerned:

$$\frac{d\xi_1}{dt} = \ . \ . \ . \ -$$

$$\frac{d\eta_1}{dt} = \ . \ . \ . \ - \frac{\nu_1}{\left[\frac{\partial^2 F_1}{\partial y_1^2}\right]_{y_1=0}} \frac{A}{2} \cos y_2 + \ . \ . \ . \ .$$

If the mean motion of y_2 is Δy_2, the perturbation of the libration-argument η_1 will be:

$$\delta\eta_1 = - \frac{\nu_1}{\left[\frac{\partial^2 F_1}{\partial y_1^2}\right]_{y_1=0}} \frac{A}{2\Delta y_2} \sin y_2.$$

Similar terms may arise from the a-periodic part of $\frac{d\eta_1}{dt}$ through the variation of x_2.

In the case of Hyperion the mean motion of the libration-argument is of the order $\sqrt{m'}$ (m' = mass of Titan), $\left[\frac{\partial^2 F_1}{\partial y_1^2}\right]_{y_1=0}$ is of the order m', A is of the order $m'e'$ (e' = eccentricity of Titan); thus the perturbation of the librational argument is of the order $\frac{e'}{\sqrt{m'}}$, as the motion of y_2 is secular (of the order m'). The numerical value of the two corresponding terms in longitude is

$$+0^\circ.202.$$

Observatory, Leiden:
1921 *August* 20.

Note on the Literal Expansion of the Motion of the Lunar Perigee.
By R. Moritz.

In the June number of the *Monthly Notices* for 1918 I published certain analytical expressions in Lunar Theory including an expansion of the motion of the perigee to the 11th power of Hill's parameter "m." It may be of interest to note that I have recently heard from M. Andoyer that he has repeated the whole of these expansions by a totally independent method, and finds that they are, without exception, correct.

LIST OF ADDITIONS

TO THE LIBRARY

OF THE SOCIETY

JUNE 1920 TO JUNE 1921.

Serial Publications received in the regular course will, in future, not be included in this Annual List.

An asterisk (*) indicates that the work is an excerpt.

Abbadia, Observatoire:

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(*Observatory.*) 4to. Hendaye, 1919

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(*Author.*) 4to. Albany, N.Y., 1920

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——: *On Comet 1919 *b* and on the Rejection of a Comet's tail.
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(*Author.*) 8vo. London, 1920

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——: Astronomisches Jahrbuch, 1917, 1918, 1919, 1920.
(*The Astronomer Royal.*) 8vo. Berlin, 1915–1918

——: Astronomisches Jahrbuch, 1922.
(*Rechen-Institut.*) 8vo. Berlin, 1920

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*Observations faites à l'Équatorial de 38 centimètres d'ouverture de 1913 à 1915 (Étoiles doubles et Comètes).
(*Author.*) 4to. Brussels, 1920

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L'Usage des Globes celeste et terrestre, et des Sphères, suivant les differens systèmes du Monde. Précedé d'un Traité de Cosmographie.
(*Col. Grove-Hills.*) 8vo. Paris, 1710

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Recherches faites à l'Observatoire de Pino Torinese sur une variation diurne de la latitude en 1919–20.
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(*Observatory.*) 4to. Bonn, 1916–1921

13. F. Küstner, Katalog von 2083 Sternen.
14. F. Küstner, Der Kugelförmige Sternhaufen Messier 56.
15. F. Küstner, Der Kugelförmige Sternhaufen Messier 15.
16. C. Mönnichmeyer, Katalog von 2199 Sternen für 1900·0.

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Tables du Mouvement Képlérien. Première Partie.
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(*Society.*) 8vo. Bordeaux, 1921

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Vol. 13. Institutiones Calculi Integralis, Vol. III.
Vol. 17. Commentationes Analyticæ, Vol. I.
Vol. 18. Commentationes Analyticæ, Vol. II.

Galilei (Galileo):
——: Dialogo . . . dove ne i congressi di quattro giornate si discorre sopra i due massimi Sistemi del Mondo Tolemaico e Copernicano.
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Die Veränderlichen Sterne. Band I. Geschichtlich-technischer Teil. Lieferung 3.
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No. 4. K. Graff. Beobachtungen von Mars, Jupiter, und Saturn, 1909 bis 1920.
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Publicaciones. Tome 6.
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(*Observatory.*) 4to. La Plata, 1921
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The Clusters *h* and χ Persei.
(*Stonyhurst College Observatory.*) 4to. (ms.) 1921

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Meridian Observations for Stellar Parallax, 1898–1905.
(*Observatory.*) 4to. Madison, Wisconsin, 1919

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